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December 23, 2003

Ms. Lynn A. Brickett
U.S. Department of Energy
National Energy Technology Laboratory
PO Box 10940, MS 922-273C
Pittsburgh, PA 15236-0940

Dear Lynn:

Subject: Final Report, "Selective Catalytic Reduction Mercury Field Sampling Project, 2002";
DOE Cooperative Agreement No. DE-FC26-98FT40321; UND Fund 4712

Enclosed please find one copy of the subject EPRI report, which includes research performed under JV Task 36.

If you have any questions, please feel free to contact me by telephone at (701) 777-5138, by fax at (701) 777-5181, or by e-mail at dlaudal@undeerc.org.

Sincerely,

Dennis L. Laudal
Senior Research Advisor

DLL/drh

Enclosure

c/enc: Richard Read, NETL

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Effect of Selective Catalytic Reduction on Mercury, 2002 Field Studies Update

Product ID #1005558

Final Report, October 2003

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CITATIONS

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Effect of Selective Catalytic Reduction on Mercury, 2002 Field Studies Update, EPRI, Palo Alto, CA; the U.S. Department of Energy National Energy Technology Laboratory, Pittsburgh, PA; and the U.S. Environmental Protection Agency, National Risk Management Research Laboratory, Air Pollution Prevention and Control Division, Research Triangle Park, NC: 2002. 1005558.

PRODUCT DESCRIPTION

This project was a joint effort between EPRI, the U.S. Department of Energy (DOE), and the U.S. Environmental Protection Agency (EPA).

Results & Findings

Selective catalytic reduction (SCR) catalysts appear to assist in converting elemental mercury (Hg^0) to oxidized mercury (Hg^{2+}). This effect appears to be more likely to occur with bituminous coals, where 90+% Hg^{2+} is possible at the particulate control device inlet. The three bituminous coal-fired power plants tested with wet flue gas desulfurization (FGD) systems achieved mercury (Hg) removals of 84%–92% with SCR operation, as compared with 43%–51% without SCR operation. These increased removal efficiencies may be due to the combined effects of the SCR system to increase Hg^{2+} concentrations and reduce reemissions of the Hg^0 from the FGD system. The effect of catalyst space velocity and age are not clear, but may have an impact on SCR Hg oxidation. The only Powder River Basin (PRB) site tested did not show a high oxidation rate. It is important to note that these findings are based on a relatively small data set and, thus, should be considered preliminary rather than final conclusions that can be extrapolated to predict the results at all other similar units. For example, two of the three FGDs tested were magnesium-lime systems, and the third FGD was a venturi scrubber; thus the combined effect of SCR and the most common FGD design of a limestone, forced-oxidation system has yet to be evaluated.

Challenges & Objectives

The objective of this study is to evaluate the effect of SCR systems on Hg speciation and removal. The most significant challenges are the complexity of the Hg chemistry and the number of possible factors that may directly or indirectly affect Hg oxidation and removal. This, along with the challenges to accurately measure Hg, must be considered when the data are interpreted, and thus caution must be taken to extrapolating the results to similar untested power plants.

Applications, Values & Use

The results will be used to help plan future control strategies as well as to assist in developing Hg regulations for coal-fired power plants.

EPRI, EPA, & DOE Perspective

This report summarizes field measurements at six power plants with SCRs conducted in 2001 and 2002. These results indicate that SCRs can increase Hg oxidation and improve Hg removal in the downstream FGD. This effect appears to be more likely for bituminous coal applications, and the effect of catalyst properties such as space velocity and age is still somewhat unclear. Additional field measurements are being conducted in 2003 to better understand the effects of

coal properties and catalyst properties and to better characterize longer-term FGD Hg removal, including the possible impact of SCRs on Hg⁰ reemissions across the FGD. Full-scale and sidestream tests are planned by this project team as well as in a separate DOE/Consol study to further evaluate the combined effect of SCRs and FGDs on Hg removal. To evaluate the effect of coal properties, measurements are planned at a pulverized-coal-fired power plant burning a PRB coal, with a second PRB site to be tested around January 2004. Additional follow-on tests to evaluate catalyst-aging effects are planned at the two power plants that indicated significant Hg oxidation in the 2001 tests and were retested in 2002. Tests are also being conducted at a power plant burning a blend of bituminous and PRB coals. Thus the results in this report should be viewed as work in progress, and the reader is encouraged to follow up and read future reports.

Approach

Hg measurements were completed at four coal-fired power plants with SCR systems in 2001 and are summarized in EPRI Report 1005400. Additional measurements were conducted in 2002 at four plants with SCR, including two plants tested in 2001 that showed significant Hg oxidation. Speciated Hg concentrations in flue gas were sampled and evaluated using the wet-chemistry Ontario Hydro method, as well as near-real-time Hg semicontinuous emission monitors. Sampling was conducted at these plants at the inlet and outlet of the SCR reactor to evaluate the effects of SCR on Hg speciation, as well as the inlet and outlet of the particulate and SO₂ control devices to evaluate Hg capture. Additional sampling involved the use of selective condensation to measure sulfur trioxide and EPA Method 27 for ammonia slip. Fly ash, FGD solids, and coal samples were also collected to estimate the Hg mass balance across the control devices.

Keywords

Mercury, Selective Catalytic Reduction, SCR, Ammonia, Air Toxics

LIST OF ABBREVIATIONS

AA	atomic absorption
AF	atomic fluorescence
CEM	continuous emission monitor (refers to plant systems)
CI	confidence interval
Cl ₂	chlorine
CO ₂	carbon dioxide
CVAA	cold-vapor atomic absorption
DOE	U.S. Department of Energy
EERC	Energy & Environmental Research Center
EPA	U.S. Environmental Protection Agency
ESP	electrostatic precipitator
F _d	emission factors calculated from coal analysis – dscf/10 ⁶ Btu
FGD	flue gas desulfurization
Hg	mercury
Hg ⁰	elemental mercury
Hg ²⁺	oxidized mercury
LOI	loss on ignition
MW	megawatt
N	normal is defined at 20°C and 1 atmosphere pressure
NH ₃	ammonia
NO _x	nitrogen oxide
OH	Ontario Hydro mercury speciation
pc	pulverized coal
PM _{2.5}	particulate matter less than 2.5 μm
PRB	Powder River Basin
PSA	PS Analytical
QA	quality assurance
QC	quality control
QMS	quality management system
Hg SCEM	mercury semicontinuous emission monitor
SCR	selective catalytic reduction
SG	Smith Greenburg
SNCR	selective noncatalytic reduction
SO ₃	sulfur trioxide
SSTP	site-specific test plan
TiO ₂	titanium dioxide
V ₂ O ₅	vanadium oxide

EXECUTIVE SUMMARY

Introduction

The objective of this report is to document the results and provide a summary of the 2001 and 2002 field tests associated with the “Selective Catalytic Reduction Mercury Field Sampling Project.” The testing was sponsored by EPRI, with additional funds provided by the utility industry, the U.S. Department of Energy (DOE) National Energy Technology Laboratory, and the U.S. Environmental Protection Agency (EPA) National Risk Management Research Laboratory. Hg measurements were completed at six different power plants, four in 2001 and two in 2002, equipped with selective catalytic reduction (SCR). In addition, two of the plants tested in 2001 were retested in 2002 for a total of eight data sets. Testing was also conducted in 2001 at two facilities that employed flue gas conditioning to improve electrostatic precipitator (ESP) performance and one that used selective noncatalytic reduction for nitrogen oxide control.

Coal combustion by electric utilities is a large source of anthropogenic mercury (Hg) emissions in the United States, according to EPA [1]. Recent data indicate that the total Hg emission from coal-fired power plants in the United States is about 45 tons/yr [2]. EPA views Hg from coal-fired utilities as a potential public health concern [3] and, as a result, is currently involved in a rule-making process that would require Hg control for coal-fired electric utilities by 2008.

Hg emissions from coal-fired boilers can be empirically classified, based on the capabilities of currently available analytical methods, into three main chemical forms: elemental mercury (Hg^0), oxidized mercury (Hg^{2+}), and particle-bound Hg. These impending Hg regulations require that control strategies be investigated and developed. The efficiency of Hg control methods depends largely on the form of Hg (gas vs. particulate) and species of Hg (elemental vs. oxidized) formed upstream of the control devices. Particulate-associated Hg (Hg_p) can be removed from flue gas by conventional air pollution control devices such as an ESP or a baghouse. Hg^{2+} compounds are readily captured in flue gas desulfurization (FGD) units. Hg^0 is most likely to escape air pollution control devices and be emitted to the atmosphere. Hg^0 , Hg^{2+} , and Hg_p concentrations are much varied in flue gas, depending on the coal composition, combustion conditions, and flue gas quench rate. Understanding the speciation of Hg is critical because control options rely heavily on Hg’s form or species. The concentration of Hg^0 , Hg^{2+} , and particle-bound Hg in the flue gas primarily depends on coal composition and combustion conditions [4].

In addition to Hg, coal-burning power plants are a significant anthropogenic source of nitrogen oxide (NO_x) emissions to the atmosphere. NO_x emissions are an environmental concern primarily because they are precursors to acid precipitation and are involved in atmospheric reactions that produce fine particles and ozone. The most common NO_x reduction strategy is the use of low- NO_x burners. These burners have the capability of reducing NO_x emissions by 40%–

60%. However, with possible establishment of stricter ozone regulations, fine particulate ($PM_{2.5}$), and regional haze, there is increased incentive to reduce NO_x emissions to a level below what can be achieved using low- NO_x burners. SCR technology, which can reduce NO_x emissions by >90%, is, therefore, becoming more attractive, particularly because catalyst costs continue to decrease and the knowledge base for using SCR reactors is expanding. It is planned that approximately 100 gigawatts of coal-fired capacity will have SCR for NO_x by 2005 [5].

Potential Impacts of NO_x SCR on Mercury Speciation

SCR units achieve lower NO_x emissions by reducing NO_x to N_2 and H_2O in the presence of ammonia. These NO_x reactions with SCR are catalyzed by metal oxides such as titanium dioxide-supported vanadium pentoxide. These SCR units are operated at about 650°–750°F (340°–399°C). Pilot- and full-scale experience in both the United States and Europe has indicated that SCR catalysts promote the formation of Hg^{2+} [6–8]. Therefore, the use of SCR to reduce NO_x emissions has the potential to improve the Hg control efficiency of existing particulate removal and FGD systems by promoting Hg^{2+} formation. Possible mechanisms that could result in the SCR of NO_x impacting Hg speciation include:

- Catalytically oxidizing the Hg.
- Changing the flue gas chemistry.
- Providing additional residence time.

EERC Pilot-Scale Tests (conducted in 2000)

In an attempt to evaluate the effects of SCR on Hg speciation, pilot-scale tests were conducted at the Energy & Environmental Research Center (EERC) [9]. The general conclusion reached based on these tests was that SCR has the potential to impact Hg speciation, but that the effects were coal-dependent. Because of the inherent concerns related to small pilot-scale tests (surface area-to-volume ratios, different flue gas chemistries, and time and temperature profiles), the project advisory and research team concluded it was necessary to conduct sampling at full-scale power plants. Therefore, EPRI, DOE, EPA, and a number of utilities began funding the EERC and other contractors to conduct Hg sampling at power plants with SCR technology.

2001 SCR Mercury Field Sampling Project

The 2001 test program was developed to address the limitations of pilot-scale testing by applying information obtained from previous work to full-scale electric-generating facilities. In general, data from 2001 testing indicated that Hg oxidation can be enhanced by SCR operation, but the effect may be moderated by a variety of factors, including coal type, catalyst chemistry and structure, and space velocity. Significant differences in Hg speciation were observed among plants with similar coal classifications [8].

Four sites with SCR systems were tested in 2001. Three of these sites fired eastern bituminous coals and one a Powder River Basin (PRB) coal. Note that for purposes of this report, the PRB site is referred to as Site S1 and the other three as Sites S2–S4. However, because the PRB site used a cyclone boiler and was operated such that the ash contained a very high concentration of

unburned carbon, it was not considered representative of a typical PRB site. For the three sites that fired eastern bituminous coals, two of the three sites showed a significant increase in Hg oxidation across the SCR unit. These two sites resulted in 89% and 90% Hg removal downstream of an FGD system. The other test site fired a coal that generated a very high concentration of Hg^{2+} , at the economizer outlet, prior to SCR.

Upon review of the 2001 test results, it was evident that additional data would be necessary to quantify the effect SCR operation had on Hg oxidation given the diversity of power plant configurations and coal sources in the United States. The most important data gaps that were identified included the following:

- The effect of firing a PRB coal in a more typical configuration
- The effect of firing a low-sulfur compliance coal
- The effect of catalyst aging
- The effect of catalyst type and space velocity

In order to address some of these data gaps, the program was expanded, and additional testing was conducted in 2002. It should be noted that the highest priority was to test an SCR-equipped plant that fires a PRB coal. Unfortunately, no plant was available for testing in 2002 with this configuration. However, plans are being made to test two SCR-equipped PRB plants in 2003 and 2004.

Approach for 2002 Field Test

The principal objective remained the same for the 2002 testing: determine the impact of SCR operation on Hg speciation and, ultimately, on Hg emissions. To achieve this objective for each unit/coal, a sampling plan was developed for various operating conditions so that the effects of SCR could be determined. At each site, tests were conducted (where feasible) under operating conditions with and without SCR in operation. This was done either by bypassing the SCR system or testing sister units, one with and one without SCR.

In addition to the effects of SCR operation, several other factors were identified as contributing factors to Hg oxidation and removal and were incorporated into the sampling plans for 2002. These factors included coal type, specifically chlorine and sulfur content, and catalyst age. A summary of the configuration of each plant is provided in Table ES-1 for 2001 and 2002 testing. Additionally, a summary of coal data for each plant is provided in Table ES-2.

Hg measurements were obtained using the manual Ontario Hydro (OH) method as well as Hg semicontinuous emission monitors (Hg SCEMs). The sampling plans were set up to obtain OH samples at the SCR inlet and outlet, ESP inlet and outlet or, in the case of one plant, a venturi scrubber and at the stack. The Hg SCEMs were used to measure Hg speciation primarily at the outlet of the particulate control device.

Table ES-1
Summary of SCR Program Plant Configuration

Plant	Year Tested	Coal	Boiler Type	Boiler Size, MW	Low-NO _x Burners	Catalyst Vendor And Type	Catalyst Age	SCR Space Velocity, hr ⁻¹	Particulate Control	Sulfur Control
S1 ^a	2001	PRB subbit.	Cyclone	650	No	Cormetech honeycomb	2 ozone seasons ^b	1800	ESP	None
S2	2001	OH bit.	Wall-fired	1300	Yes	Siemens/Westinghouse plate	3 months	2125	ESP	Wet FGD
S2-2	2002	OH bit.	Wall-fired	1300	Yes	Siemens/Westinghouse plate	2 ozone seasons	2125	ESP	Wet FGD
S3	2001	PA bit.	Tangential-fired	750	Yes, with overfire air	KWH honeycomb	1 ozone season	3930	ESP	None
S4	2001	KY bit.	Cyclone	650	No	Cormetech honeycomb	1 ozone season	2275	Venturi scrubber	Venturi scrubber
S4-2	2002	KY bit.	Cyclone	650	No	Cormetech honeycomb	2 ozone seasons	2275	Venturi scrubber	Venturi scrubber
S5	2002	WV bit.	Wall-fired	684	Yes	Halder-Topsoe plate	3 months	3700	ESP	Wet FGD
S6	2002	Low-sulfur KY and WV bit.	Concentric-fired	700	Yes	Cormetech honeycomb	2 ozone seasons ^c	3800	ESP	None

^a Not discussed in detail in this report.

^b The ozone season is from May 1 through September 30.

^c One layer of catalyst was replaced after one ozone season.

Table ES-2
Summary of Coal Analyses^a for Plants Tested in 2001 and 2002

	S1	S2	S2-2	S3	S4	S4-2	S5	S6
Mercury, $\mu\text{g/g}$ dry	0.10	0.17	0.14	0.40	0.13	0.18	0.13	0.07
Chlorides, $\mu\text{g/g}$ dry	<60	1333	523	1248	357/1160 ^b	270	472	1020
Moisture Content, %	27.5	7.6	6.1	7.0	10.5	8.3	4.6	6.1
Ash, %	3.7	11.7	9.4	14.0	9.1	9.1	12.1	11.6
Sulfur, %	0.19	3.9	3.9	1.7	2.9	3.0	3.6	1.0
Heating Value, Btu/lb	8960	11,092	12,097	11,421	11,341	12,077	12,120	12,019

^a As-received unless otherwise noted.

^b First value prior to bypass; second value postbypass.

Description of Sites Tested in 2002

Site S2

Site S2 was tested in 2001 and again in 2002 to collect data after an additional ozone season (May 1–September 30) of operation on the SCR catalyst. Unfortunately, a number of operational changes, including addition of SO₃ mitigation technologies and a change in the coal (as shown by the chloride values in Table ES-2), between 2001 and 2002 at Site S2 may have affected the results. In addition, operational problems occurred (plugging of the air preheater) at Site S2 in 2002 that resulted in a somewhat reduced test plan. The OH and Hg SCEM data were collected for the SCR on-line condition, but only Hg SCEM data were obtained for the SCR off-line condition.

Site S4

Site S4 was tested in 2001 and again in 2002 to collect data after an additional ozone season of operation on the SCR catalyst. At Site S4, sampling was done with the SCR unit on-line followed by tests with the SCR unit off-line on the same unit. Based on Table ES-2, there was significant variability in the coal from one year to the next.

Site S5

Site S5 was selected to provide additional data on the impact of SCR for a facility firing a high-sulfur eastern bituminous coal and utilizing a wet FGD system for SO₂ control. Hg sampling at Site S5 was done on two sister units: one with an SCR unit, the other without.

Site S6

Site S6 was selected to represent facilities firing a low-sulfur compliance coal. Hg sampling at Site S6 was done on two sister units (one with SCR and the other with the SCR unit bypassed).

As part of another test program that was being conducted simultaneously with the SCR project, Hg sampling was also done at the stack of a third unit (no SCR).

Mercury Emission/Capture Results for 2002 Field Tests

There were two primary objectives for the Hg testing in 2002. The first was to determine the Hg oxidation potential of the SCR catalysts at each test site. The second was to determine what impact SCR had on the Hg removal efficiency of each pollution control device. The overall Hg removal (unless otherwise specified) is defined as the Hg measured at the stack compared to Hg measured at the inlet to the particulate control device.

Site S2

Site S2 was sampled in both 2001 and 2002 to determine the effect of operating SCR over an additional ozone season on Hg speciation. Units equipped with SCR are required to operate the SCR unit from May 1 to September 30 (ozone season) for plants burning bituminous coals, as is the case for Site S2. To evaluate catalyst aging on Hg speciation, the OH results for 2002 Hg sampling are compared to those obtained during 2001 testing. A summary of these results is provided in Figure ES-1. For this site, results show 54% and 48% Hg^{2+} at the SCR inlet for 2002 and 2001 sampling respectively. At the SCR outlet, oxidation of Hg across the SCR unit resulted in Hg^{2+} of 87% and 91% for 2002 and 2001, respectively. Comparing these results shows that the oxidation of Hg across the SCR did not significantly change from 2001 to 2002. This is also shown by comparing the ESP inlet sampling results, which was 97% Hg^{2+} for both years.

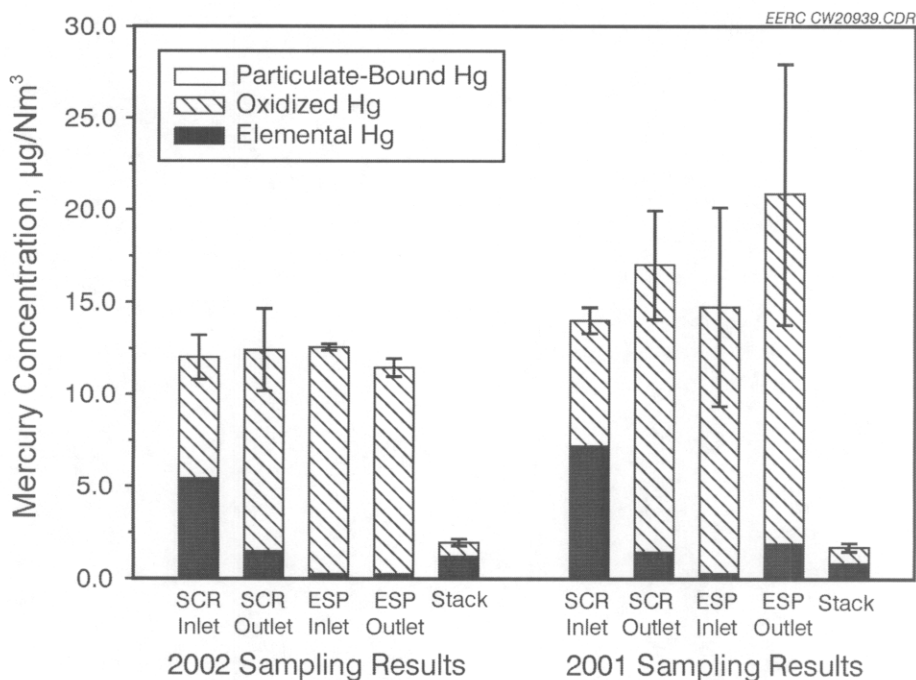


Figure ES-1
Mercury Results Comparing Speciation with SCR from 2001 and 2002 at Site S2

The overall Hg removal in 2002 across the ESP and wet FGD was 84% compared to 89% in 2001. Operational problems at the plant prevented Hg sampling using the OH method with the SCR bypassed. Therefore, a comparison of Hg speciation with and without SCR was not possible using 2002 OH results. However, in 2001, Hg removal was only 51% when the SCR unit was bypassed.

The Hg SCEMs were operated at Site S2 for approximately 1 month and included the time the SCR unit was bypassed. Review of the Hg^0 SCEM data illustrates an increase from $<0.25 \mu\text{g}/\text{m}^3$ to approximately $1.0 \mu\text{g}/\text{m}^3 \text{Hg}^0$ when the SCR unit was bypassed.

Site S4

Site S4 was also tested in both 2001 and 2002. A comparison of the 2001 and 2002 results are shown in Figure ES-2. For this site, results show 33% and 9% Hg^{2+} at the SCR inlet for 2002 and 2001 sampling, respectively. At the SCR outlet, oxidation of Hg across the SCR unit resulted in Hg^{2+} of 63% and 80% for 2002 and 2001, respectively. Although this difference may have been attributable to a catalyst-aging effect, the coal fired at Site S4 varied, especially with respect to the chloride content. In 2001, the measured coal chloride content ranged from 350 to 1280 ppm and in 2002 was much closer, ranging from 240 to 300 ppm. Plant personnel indicated that the coal was from the same mine for both years. The information collection request coal analysis data from 1999 for Site S4 also indicated a wide range of chloride concentrations in the coal.

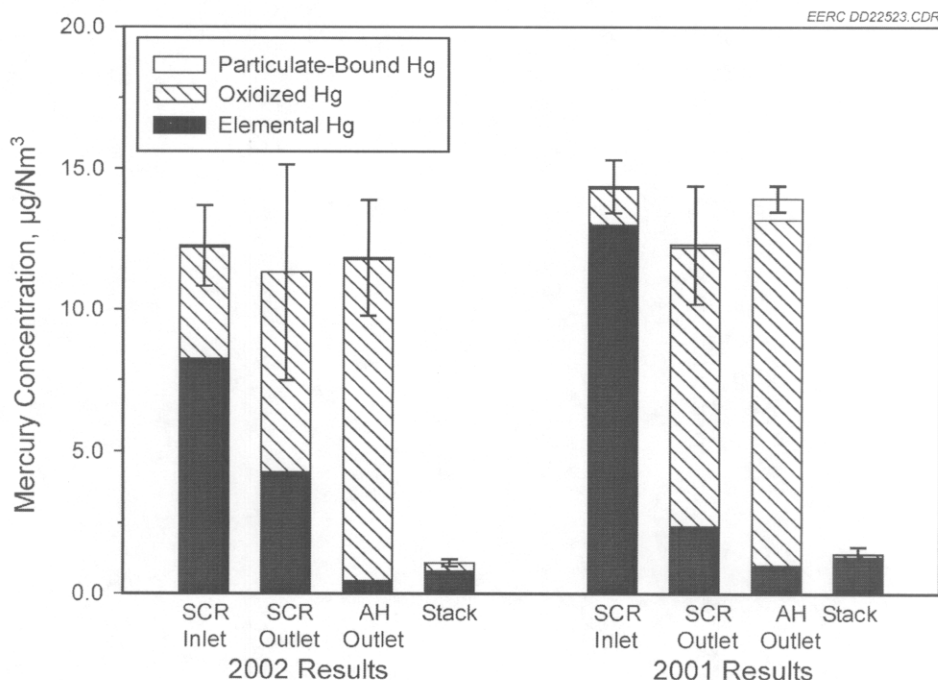


Figure ES-2
Mercury Results Comparing Speciation with SCR from 2001 and 2002 at Site S4

Although there was a substantial decrease in Hg oxidation across the SCR catalyst between 2002 and 2001, downstream of the air preheater and just prior to the inlet of the venturi scrubber, there

was an increase in the percentage of Hg^{2+} . In 2002, 96% of the Hg was measured as Hg^{2+} at the outlet of the air preheater compared to 87% in 2001. It is possible that this difference may be the result of the changing coal composition. The overall Hg removal efficiency across the venturi scrubber was essentially the same in 2002 and 2001: 93% and 90%, respectively.

Figure ES-3 compares the OH Hg speciation results with SCR in operation and with SCR bypassed. At the air preheater outlet sampling location, 96% of the Hg is oxidized with SCR compared to 57% without SCR in service. In 2001, the comparison was 87% and 56%. As stated above, the overall Hg removal efficiency across the venturi scrubber was 93%; this is compared to only 44% when SCR was bypassed. This is supported by the Hg SCEM data that showed the average Hg^0 concentration increasing from 1.1 to $6.4 \mu\text{g}/\text{m}^3$ when SCR was bypassed.

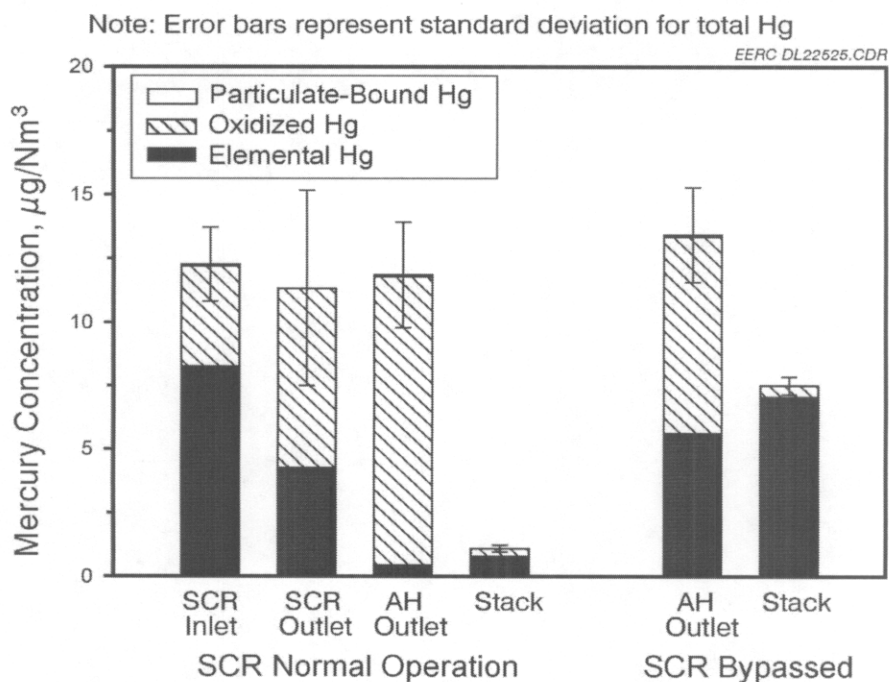


Figure ES-3
Comparisons of Mercury Speciation with the SCR in Service and with the SCR Bypassed at Site S4

Site S5

The Hg results for Site S5 are summarized in Figure ES-4. As can be seen in Figure ES-4, Hg^{2+} increased from 44% to 81% across the SCR catalyst and was 95% at the ESP inlet sampling location. For the unit without SCR, the percentage of Hg^{2+} at the ESP inlet was 80%. The overall Hg removal efficiency across the ESP and wet FGD was 90% for the unit with SCR. This is compared to 51% for the unit without SCR. It should be noted that the results for the unit without SCR showed an increase in Hg^0 (4.7 to $6.1 \mu\text{g}/\text{Nm}^3$) across the wet FGD. The increase in Hg^0 was considerably less (0.7 to $1.0 \mu\text{g}/\text{Nm}^3$) for the unit with SCR.

Note: Error bars represent standard deviation of total Hg.

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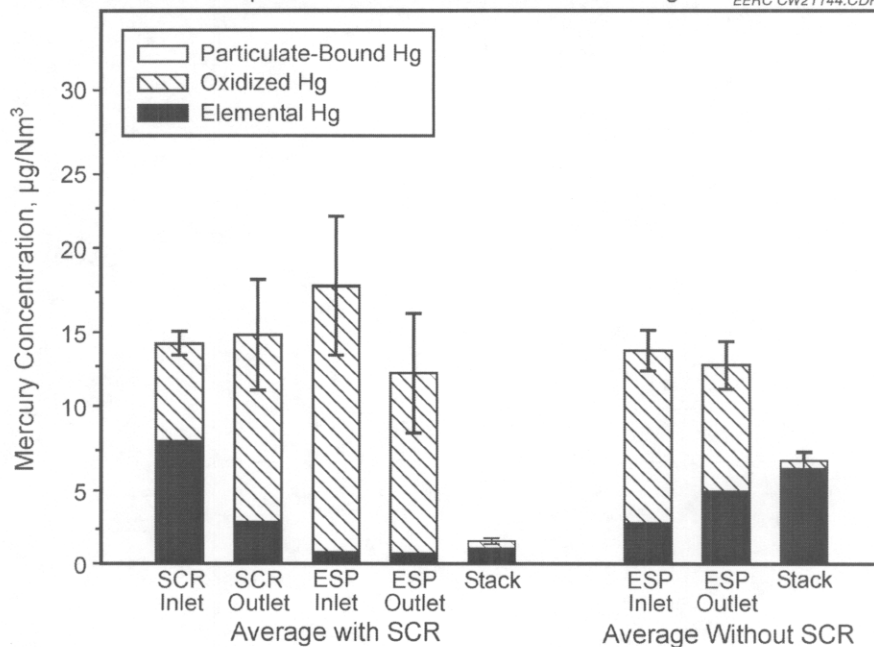


Figure ES-4

Mercury Speciation Results Compared for a Unit with SCR and Without SCR at Site S5

Site S6

The results of flue gas testing from S6 are summarized in Figure ES-5. Hg^{2+} increased from 64% to 83% across the SCR catalyst and was 87% at the ESP inlet sampling location. For the unit with SCR bypassed, the percentage of Hg^{2+} at the ESP inlet was 69%. However, as shown in Figure ES-5, there appeared to be more particulate-bound Hg measured when SCR was bypassed.

The test at Site S6 was conducted to evaluate the impact of SCR on Hg speciation when a low-sulfur compliance coal was fired; therefore, there was no wet FGD system on either test unit. Within the variation of the data, the presence of SCR had no apparent effect on Hg removal across the ESP (there was little if any for either case). Also, the Hg measured at the stacks had a high percentage of Hg^{2+} : 92% with SCR and 88% without SCR.

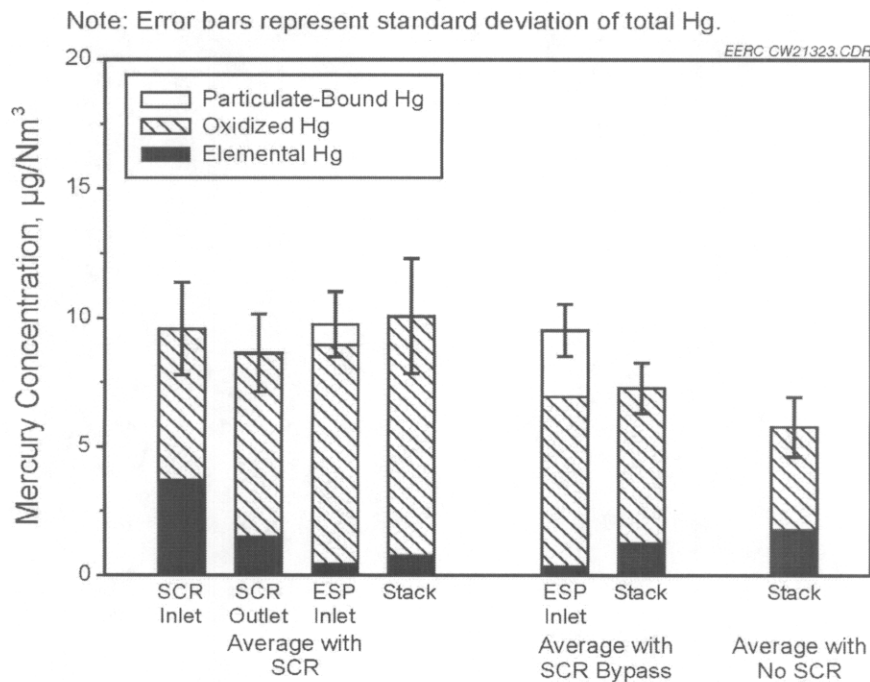


Figure ES-5
Mercury Speciation Results Comparing Units with and Without SCRs in Service at Site S6

Discussion of Overall Results

The primary goal of this project is to evaluate the effect SCR operation has on Hg speciation and, ultimately, on Hg emissions. The combined results from 2001 and 2002 testing are discussed below.

Effect of SCR on Mercury Speciation

Table ES-3 presents the results of both the 2001 and 2002 testing. There is an increase in Hg oxidation across the SCR catalyst for those plants firing an eastern bituminous coal. However, the amount of oxidation that occurs across the catalyst is highly variable. It appears to be affected by coal properties as well as catalyst design and, possibly, catalyst age.

Although there is strong evidence that an SCR catalyst does promote Hg oxidation, to determine the overall effect of SCR, it was useful to conduct tests both with and without SCR in service at each site. Figure ES-6 shows the comparison. For three of the five sites, there is a higher concentration of nonelemental Hg (Hg^{2+} and particulate-bound Hg) when an SCR unit was present, based on measurements made at the inlet to the particulate control device. For the other two sites, S3 and S6, the percentage of nonelemental Hg was >90%, both with and without an SCR unit in service.

Table ES-3
Change in Mercury Oxidation across the SCR Catalyst

Site	Year Sampled	SCR Inlet Hg ²⁺ , % of total Hg	SCR Outlet Hg ²⁺ , % of total Hg	Percentage Point Increase, ^a %
S1 ^b	2001	8	18	10
S2	2001	48	91	43
S2	2002	54	87	33
S3	2001	55	65	10
S4	2001	9	80	71
S4	2002	33	63	30
S5	2002	43	76	33
S6	2002	60	82	22

^a Defined as (SCR Outlet % - SCR Inlet %).

^b Site S1 fired a PRB coal; the others were eastern bituminous coals.

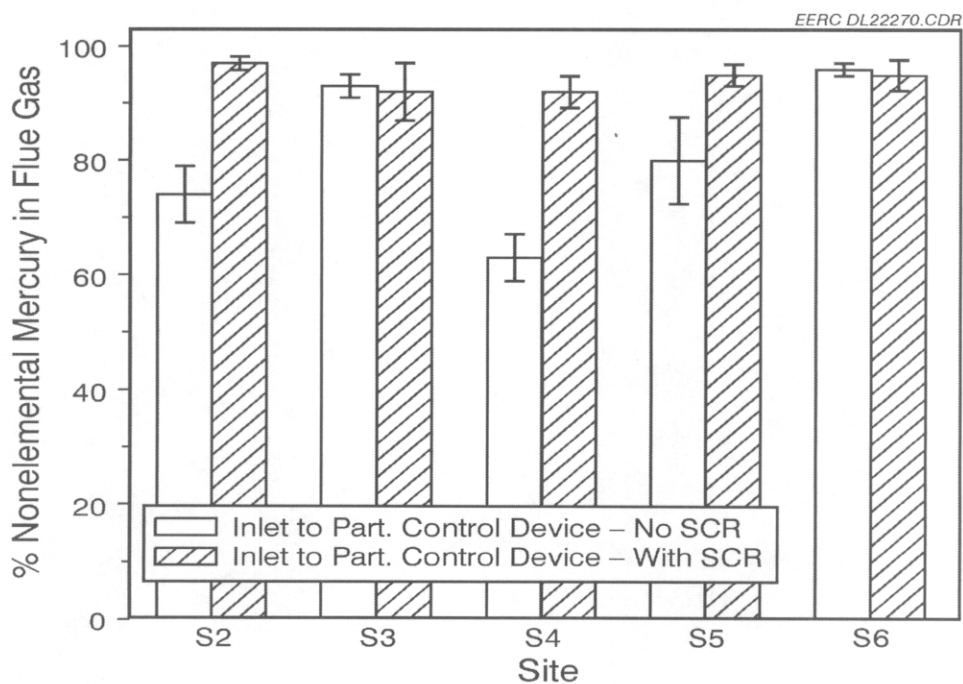


Figure ES-6
Mercury Concentrations at the Inlet of the Particulate Control Device with and Without the SCR, respectively